

ROCKS and MINERALS

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Contents For August, 1935

	PAGE
The Boulder, Colorado, Tungsten Area. By Ronald L. Ives	113
Amber. By Jonathan M. Blair	116
An Early Check List of Black Hill Minerals. By Titus Ulke	120
Anthracite Coal Found in West Hartford, Conn. By C. W. Hoadley	123
Field Museum Has Large Fossil Turtle	123
Lake City Mining District, Colorado. By David Seaman	124
Club and Society Notes	125
New Haven Mineral Club	125
Four Uncommon Non-Metallic Occurrences in Kentucky. By Wm. C. McKinley	126
Collector's Kinks	126
The Amateur Lapidary. Conducted by J. H. Howard	127
Polishing Flats on Soft Mineral Specimens. By Arthur Knapp	127
Mineral Oddities	127
Blowpipe Analysis. Reviewed by H. Alban Anderson	128

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ROCKS AND MINERALS

PEEKSKILL, N. Y., U. S. A.

The Official Journal of the Rocks and Minerals Association

GILBERT HART -- Geologist

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The Boulder, Colorado, Tungsten Area

By RONALD L. IVES

Since the early days of placer mining in Colorado, those who panned the creeks of the high country in Boulder County were annoyed and irritated at a peculiar "black iron" which remained in the pan, and greatly interfered with gold recovery.

In 1900, a prospector, W. H. Wanamaker, discovered the real nature of the "black iron," and began, with his partner, Sam Conger, to ship Ferberite and other tungsten ores. Forty tons of high grade ore were shipped the first year. From this small beginning, the tungsten area increased its production until, during the war, more than 2,000 tons of concentrate were shipped; Nederland, the largest town, had "thirty saloons and a shooting every night" (so the "old timers" say); then reduced its production, as the "easy money" mines played out, until Nederland almost joined the ranks of "Ghost Towns." From 1928 on, tungsten has again been a paying business, as miners began to work the mines of lower grade ore. Now, despite fluctuating markets, uncertainty of tariff protection, and a gold boom, the tungsten mines are being worked quite steadily, and at a reasonable profit.

The tungsten area is located in the high country of Boulder County, Colorado, near the town of Nederland, which is 20 miles west of Boulder, and roughly 40 miles northwest of Denver. It is located at an altitude of about 9,000 feet, in the so-called foothills area.

The country rock consists of mineralized and metamorphosed granite, of the Idaho Springs formation. The for-

mation is pre-Cambrian, with three, and possibly four mineralizations, the last being Tertiary. The tungsten minerals are supposed to have been introduced during the earlier, pre-Tertiary, and possibly pre-Cambrian, mineralizations. Close proximity to the Caribou silver, iron, titanium, manganese, tungsten deposit, which is probably a magmatic segregation, complicates the problem of mineralizations considerably. Except for very small areas, only reconnaissance work has been done on the geology.

Commercial tungsten minerals are Hubnerite, Ferberite, Wolframite and Scheelite, of which the first three are of greatest importance and interest. These occur in faulted areas as cement between pieces of fault breccia, and most of the mines produce all three. Roughly, they are all $(\text{Fe}, \text{Mn}) \text{WO}_4$, with Ferberite containing mostly tungstate of iron, Wolframite containing about equal amounts of manganese and iron tungstates, and Hubnerite containing mostly manganese tungstate. A classification for minerals having the $(\text{Fe}, \text{Mn}) \text{WO}_4$ formula, first suggested by Dr R. D. George and now generally accepted, is as follows:

0-20% MnWO_4 ,
remainder FeWO_4 Ferberite
20-80% MnWO_4 ,
remainder FeWO_4 Wolframite
0.20% FeWO_4 ,
remainder MnWO_4 Hubnerite

It is obvious from this classification that only by a quantitative analysis can the three minerals be surely classified.



(Photo by McClure)

Courtesy of Colorado Geological Survey
Interior of Boulder County Tunnel. This tunnel has tapped veins of tungsten, silver and gold.
When completed it will tap the famous Carbou Silver Veins.

Due to the several mineralizations of the tungsten area, there is an appreciable gold content in the tungsten minerals, which so far has not been recovered.

Prices for tungsten concentrate vary greatly from year to year, and even from month to month. The concentrate is sold in units, containing 33 1/3 lbs of material, assaying 65% WO₃. Recently, the price has been around \$12.00 a unit delivered at the railroad.

Today, tungsten is mined in the Boulder area by hard rock methods exclusively, trucked to Nederland, where it is milled and concentrated, then trucked 18 miles through the canyon of Middle Boulder Creek to Boulder, where it is shipped by rail to the steel mills of the east. Frequently, the tungsten minerals are not refined to metallic tungsten before use, but are mixed with iron ores in known proportions, the mix then being smelted. Thus, the tungsten forms alloys directly with the iron in the smelting, saving one heat.

Although nearly all of the high grade tungsten ore, and all of the "placer tungsten" has been exhausted, operators claim that they have large amounts of medium grade ore available. In normal times, 50 to 75 men are employed steadily at good wages in the mining, milling and trucking of tungsten minerals.

Characteristics of and Tests for Ferberite, Wolframite and Hubnerite

Ferberite (Fe,Mn)WO₄ contains not over 20% MnWO₄.

Wolframite (Fe,Mn)WO₄ contains more than 20% and less than 80% MnWO₄.

Hubnerite (Fe,Mn)WO₄ contains more than 80% MnWO₄.

Color

Ferberite—black to blue-black to faint brownish-black.

Wolframite—dark grayish to brownish black.

Hubnerite—blackish-brown to seal-brown to hair-brown, occasionally blue-black.

Luster—submetallic to metallic. Ferberite sometimes brilliant metallic on cleavage faces. Hubnerite sometimes adamantine.

Crystallization—monoclinic. Good crystals extremely rare.

Cleavage—one, perfect.

Fracture—uneven.

Tenacity—brittle, friable.

Hardness—Ferberite 4.5--5.5; Wolframite 5-5.5; Hubnerite 5-5.5.

Streak—Ferberite - gray - black to black to brownish - black.

Wolframite—nearly black.

Hubnerite—grayish-black, dark reddish-brown to yellowish-brown to greenish-gray.

Specific gravity—7.2 - 7.5.

Occurs—crystallized crusts, druses and vug-linings; also massive and granular.

Associations—tin ores, tourmaline, fluorite, topaz, beryl, and other tungsten minerals.

Tests—Fuses to a weakly magnetic globule. Soluble in strong HCl, or in aqua regia, with formation of yellow powder which, when boiled with zinc or tin, forms a fine blue solution. Reacts for manganese with soda on platinum foil. Ferberite sometimes does not react for manganese. Hubnerite reacts very strongly for manganese.

These tests taken from "Common Minerals and Rocks" by Dr. R. D. George, State Geologist (of Colorado). They have been somewhat condensed from the original.

The many friends in the Rocks and Minerals Association of Stephen Varni, of Stephen Varni Company, will be grieved to learn that Mr. Varni's son, Stephen Jr., passed away June 29th at

his home in Brooklyn. The young man was 24 years of age. We are sure the sympathy of all those who read this sad announcement will be extended to Mr. and Mrs. Varni.

Amber

By JONATHAN M. BLAIR

Historical

Amber claims the highest antiquity among precious stones used for personal adornment, and was anciently considered the most precious of jewels.

Since the earliest records amber has been cast up on the shores of the Baltic, and it was used by peoples as early as the Stone Age for ornaments and amulets.

The Hebrew name for amber was 'hashmal'. (Ezekiel i, 4).

It was the one precious stone known to the early Greeks, who called it Electrum on account of its electrical susceptibilities. The Greeks bought worked amber from the Phoenicians, who sailed to the Baltic for the sole purpose of obtaining this mineral and amber ornaments are found in the prehistoric graves of the Greeks at Mycenae, a ruined city in the states of Argolis and Corinth, Greece.

It has also been found among the remains of the cave dwellers of Switzerland, and in Assyrian and Egyptian ruins of prehistoric age.

Composition

Average composition $C_{10}H_{16}O$.

True amber yields, on dry distillation, succinic acid, the proportion varying from 3-8%, being greatest in the pale opaque or bony varieties. The aromatic and irritating fumes emitted by burning amber are mainly due to this acid. True Baltic amber is distinguished by its yield of succinic acid, for many of the other fossil resins which are often termed amber contain either none of it, or only a very small proportion; hence the synonym 'succinite' now commonly used as a specific term for the real Prussian amber. It is a poor term for use in mineralogy, and highly confusing, as it is also applied to a variety of garnet.

Structure

In amorphous masses to chunks a foot or more in diameter, up to 10 lbs. in weight.

Over 150 different species of insects have been found entombed in amber, many of them identical with present-day insects, while most of the plants embedded in amber are different from

the vegetation now found in the amber regions.

Inclusions

The turbidity of certain kinds of amber is due to the inclusion of great numbers of minute air bubbles. Various other enclosures are found, some of which are of special significance. Drops of water sometimes occur, but enclosures of solid matter, either organic or inorganic, are more frequent. The enclosures of organic material, partly of vegetable and partly of animal origin, are of great importance as they have thrown much light on the flora and fauna existing at the time of the exudation of the amber. Some of the more common organic inclusions are:

1. Snapping beetles
2. 'Star hairs'
3. Ants
4. Spring Tails
5. Hymenoptera
6. Larva of Cicada
7. White Ants
8. Crane Flies
9. Flies
10. Spiders
11. Moths
12. Leaf Scales
13. Cypselidae
14. Dolichopodidae
15. Leaves of Dicotyledon

Specific Diaphaneity

Transparent.

Resinous.

Luster

Color

Coloring very uniform, no color but yellow occurring in the great majority of specimens, though all shades of this color, from the palest yellow to brown, are known.

Usually wine-yellow. Occasionally white, yellowish-white, orange-yellow, brown-yellow, greenish, brown, red-brown, yellow-brown, brown-black, cloudy. Rarely red.

Optics

Amber is probably the best example of limpidity known. If it encloses insects, for instance, the shadow of the insect can be seen through the amber in a polished specimen. The amber of

the Baltic Sea region almost invariably encloses insects.

Shows bright interference colors in polarized light.

Luminescence

Occasionally fluorescent bluish-green under the argon bulb, but only on the surface of a fresh fracture.

Hardness

2-2.5 (a little harder than gypsum, therefore just not possible to scratch it with the finger-nail). Too soft for extensive use as a gem. Some amber is fragile.

Tenacity

Harder than most other resins but is not very brittle, and can therefore be carved, worked on the lathe or bored with little difficulty. Bears a high polish.

Fracture

Perfect conchoidal fracture.

Specific Gravity

1.05-1.1, thus only slightly heavier than water. Noticeably light.

Electrical Properties

When rubbed on cloth becomes strongly charged with negative electricity and attracts small light particles. A very good insulator for use in electrical apparatus and is superior to sulphur because of its mechanical properties.

Pyrognostics

Burns silently, with little smoke, emitting a not unpleasant bituminous odor.

Soluble in oils when gently heated.

Differentiation

Resembles copalite, but copalite while burning crackles and emits an aromatic resinous odor, while amber burns silently and emits an odor distinctly bituminous.

Amber is a very bad conductor of heat, being perceptibly warm to the touch, and for this reason can be readily distinguished from glass imitations, which are also much heavier than genuine amber.

Distinguished from imitations, such as rosin and celluloid, by being less inflammable, though it burns readily with a rich yellow flame, yielding an aromatic odor.

Distinguished from most minerals by being extremely light (1.05-1.1, noticeably light), and soluble in alcohol.

Use

Used chiefly as material from which to manufacture varnish.

Used for beads.

Faceted gems are cut from special varieties, especially simetite.

Trade

Amber begins to soften at 150 deg. C., and finally melts at 250-300 deg. This enables dealers to produce a large quantity of an inferior amber called ambroid, by the fusion under pressure of small comparatively worthless pieces of amber into large compact cakes. Ambroid is used where a cheaper material than the natural amber is required, but, while it is a good substitute for many purposes, it lacks the brilliancy and fine wearing qualities of the natural stone.

Lore

Amber is used today in Lombardy and the Piedmont as a cure for gopher—a belief that dates back to the time of Pliny.

Comparative

Mass of 18 lbs. Royal Museum, Berlin.

Mass as large as a child's head, 2½ lbs. Intersected by calcite veins, from the thickness of paper to 1/20 inch. Ava kingdom, India.

Sicily. Pendant, brown. 19.3 k. 45 x 18 x 10 mm. No. 672, U. S. Nat. Mus.

Necklace of 62 faceted beads, graduated. Yellow-brown. No. 677, U. S. Nat. Mus.

Genesis

Amber and the smaller fossil resins are of vegetable origin, altered by fossilization. This is inferred from its native situation with coal, on fossil wood, and from the occurrence of insects incased in it. Of these insects, some have struggled after being entangled in the thin viscous fluid, and occasionally a leg or wing is found some distance from the body, which had been detached in the effort to escape.

At least 8 species of plants besides the *Pinus Succinifer* (amber tree) have afforded these fossilized resins, and 163 species are represented by remains in them. Besides pines, species of the family *Abietineae* and *Eupressineae* have contributed to them. The insects have been preserved with remarkable fidelity, so that not only are their most delicate membranes intact, but in many cases an idea of the original color can be obtained.

Occurrence

Found in placer deposits, with lignite, bitumen and jet.

Geologic Horizon

Associated with lignite beds of Middle Tertiary age.

Foreign Localities

Burma, British India. Precious amber. Yellow-brown.

Promontory of Samland, E. Prussia prov., Prussia principality, Germany; Danzig (W. Prussia prov.) to Memel (E. Prussia prov.), especially between Pillau (E. Prussia prov.) and Dorf Gros Hubnicken. The greatest amber-producing region in the world. Precious amber abundant. Occurs in a marine glauconitic sand, known as 'blue earth,' occurring in the Lower Oligocene strata. Under a stratum of sand and clay 20 feet thick, there succeeds a stratum of trees 40 - 50 feet thick. The wood is partly decomposed, and impregnated with pyrite and bitumen, and is of a blackish - brown color. Under a stratum of trees, and sometimes attached to them, the amber is found.

Poland. Lemberg, Lemberg prov., Galicia principality, Poland (formerly Austria).

Mizau, Galicia principality, Poland (formerly Austria).

Boskowitz, Moravia prov., Czechoslovakia (formerly Austria).

Skuc, Bohemia prov., Czechoslovakia (formerly Austria). Dark honey-yellow. Hard.

Adriatic Sea shores.

Basel (Bale) canton, N. W. Switzerland.

Paris, Dept. of Lower Alps, France.
Christiania, Smaal-Ebnene prov., Christiana principality, Norway.

Greenland.

S. Mexico. Exact locality unknown. Precious amber. Rich golden-yellow, rivals the Baltic material. Brought out of the jungles by Indians for trading purposes.

U. S. Localities

Cape Sable, Ann-Arundel Co., Md. In grains or masses 4/5 inches in diameter, in a lignite bed.

Near Trenton, N. J. Small grains on or penetrating lignite and carbonized wood.

Camden, N. J. (opp. Philadelphia, Penn.). Transparent specimens several inches in diameter.

Varieties

There are many varieties and subspecies of amber. Refer to Dana's **System** for detailed descriptions. We will here only consider a few of the more precious types, as follows:

1. Copalite.
2. Krantzite.
3. Rosthornite.
4. Rumanite.
5. Siegburgite.
6. Simetite.
7. Walchowite.
8. Duxite

Copalite (copal)

Differentiation

From amber: Melts at a lower temperature, 210 deg. C. Slightly harder (2.5) than most amber.

Genesis

Copalite is the dried sap of leguminous and coniferous trees which are found in many parts of the world, such as New Zealand, Australia, Madagascar, the east and west coasts of Africa, and various places in South America. Nine-tenths of the copal used is obtained from deposits buried sometimes as deeply as 20 feet and often thousands of years old.

The author has a 1-inch specimen from Zanzibar coast enclosing a spider and a cockroach.

Krantzite

Color

Light yellow or green-yellow; but reddish or brownish by reflected light.

Tenacity

Rather tender. Sectile, somewhat elastic.

Fusibility

225 deg. C., at 288 deg. perfectly fluid.

Pyrognostics

Only softens in turpentine. In sulphuric acid gives a brown solution. Ether solution affords a brownish amorphous substance, elastic like caoutchouc at 12 deg. C.

Rosthornite

Color

Brown, with garnet-red reflections; in thin splinters wine-yellow.

Fusibility

At 96 deg. C. commences to melt to a viscous brown-red mass, which at 160 deg. gives off bubbles, at 205 deg.

white fumes, at 225° deg. evolution of gas ceases, leaving a thick dark purple-red fluid.

Pyrognostics

Completely soluble in benzene at ordinary temperatures.

Occurrence

In coal.

Rumanite

Specific Diaphaneity

Transparent.

Color

Usually brown-yellow or brown. Occasionally yellow.

Tenacity

Hardness 2.5-3. Brittle.

Fusibility

Melts without previous swelling up at 300° deg. C.

Pyrognostics

Not acted upon by nitric acid in the cold, but when warm oxidized to a yellow crumbling substance.

Distribution

Local to Rumania. Found at Buseo and Telage. Bohosa.

Sieburgite

Structure

In concretionary masses in which the resin is mixed with 50%, or more of quartz sand, which, in the form of small granules, it cements together.

Color

Hyacinth-red, brown-red, gold-yellow.

Tenacity

Hardness 2-2.5.

Pyrognostics

Partially soluble in ether, which is colored yellow and after evaporation yields a yellow oil without separation of crystals.

Distribution

Local to Lower Rhine. Found at Sieburg and Troisdorf.

Simetite

Color

Usually garnet-red, dark red, occasionally yellowish-red. Flashing in the sunlight, it shows beautiful color shades (due to natural fluorescence), ranging from pale rose to intense pigeon-blood red; green; and from faint blue to deepest azure. Appears nearly black by reflected light.

Luminescence

Fluorescent under argon bulb.

Differentiation

GAL SIX

Remarkable for its deep red color.

Trade

Faceted into brilliants, as the diamond. This is the precious amber so glibly spoken of, but so little understood, and not the material from the Baltic and elsewhere.

Distribution

Local to Sicily. Found at Catania on the coast and at Mt. Etna.

Walchowite

Specific Diaphaneity

Translucent.

Color

Honey-yellow, green-yellow, yellow striped with brown.

Hardness

1.5-2.

Pyrognostics

Fuses to a yellow oil at 250° deg. C. and burns readily; becomes transparent and elastic at 140° deg.

With sulphuric acid forms a dark brown solution.

Distribution

Local to Moravia. Found at Litezko and Uttigshof, at Walchow in brown coal.

Duxite (Var. of walchowite)

Color

Opaque dark brown only.

Fusibility

246° deg. C.

Distribution

Local to Dux, Bohemia. In lignite.

An Early Check List of Black Hill Minerals

By TITUS ULKE, M.E.

As Collected and Reported to May, 1891, by the Author

- | | |
|--------------------------|-----------------------------|
| 1. Actinolite | 55. Gold |
| 2. Agate | 56. Graphite |
| 3. Alabaster | 57. Grossularite |
| 4. Albite | 58. Gypsum |
| 5. Almandite | 59. Halite |
| 6. Alum | 60. Hematite |
| 7. Amethyst | 61. Heterosite (reported) |
| 8. Amphibole | 62. Hydraulic limestone |
| 9. Andalusite | 63. Ice |
| 10. Ankerite | 64. Iceland Spar |
| 11. Antimony ocher | 65. Ilmenite |
| 12. Apatite | 66. Iron Sinter |
| 13. Aragonite | 67. Iron Stone |
| 14. Argentite | 68. Jasper |
| 15. Arsenopyrite | 69. Jefferisite |
| 16. Asbestos | 70. Kaolinite |
| 17. Auriferous pyrite | 71. Killinite |
| 18. Autunite | 72. Labradorite |
| 19. Azurite | 73. Lepidolite |
| 20. Barite | 74. Leucopyrite |
| 21. Beryl | 75. Liebenerrite (reported) |
| 22. Biotite | 76. Lignite |
| 23. Bismuth (native) | 77. Limonite |
| 24. Calcite | 78. Lollingite |
| 25. Carnelian | 79. Magnetite |
| 26. Cassiterite | 80. Malachite |
| 27. Cerargyrite | 81. Marble |
| 28. Cerussite | 82. Marcasite |
| 29. Chalcedony | 83. Margarite |
| 30. Chalcocite | 84. Martite |
| 31. Chalcopyrite | 85. Melanite |
| 32. Chert | 86. Menaccanite |
| 33. Chlaxtolite | 87. Microcline |
| 34. Chrysocolla | 88. Molybdenite |
| 35. Chrysolite (olivine) | 89. Muscovite |
| 36. Cinnabar | 90. Nephelinite |
| 37. Clay Iron Stone | 91. Obsidian |
| 38. Cleavelandite | 92. Ocher (red) |
| 39. Coal (bituminous) | 93. Ocher (yellow) |
| 40. Columbite | 94. Oolite |
| 41. Copper Glance | 95. Opal |
| 42. Copper (native) | 96. Orthoclase |
| 43. Corundum | 97. Penninite |
| 44. Cuprite | 98. Petroleum |
| 45. Cuprocassiterite | 99. Pingersite |
| 46. Cymatolite | 100. Plumbic Ocher |
| 47. Dog Tooth Spar | 101. Prochlorite |
| 48. Dolomite | 102. Proustite |
| 49. Emerald | 103. Psilomelane |
| 50. Epidote | 104. Pyrite |
| 51. Feldspar (anorthite) | 105. Pyrolusite |
| 52. Fibrolite | 106. Pyromorphite |
| 53. Flint | 107. Pyroxene (augite) |
| 54. Galena | 108. Pyrrhotite |

109. Quartz
110. Ripidolite
111. Rose Quartz
112. Rutile
113. Sanidine
114. Satin Spar (gypsum)
115. Scapolite
116. Scorodite (reported)
117. Selenide of Gold
118. Selenite
119. Serpentine
120. Siderite
121. Silver
122. Sphalerite
123. Spodumene
124. Stalactite and Stalagmite (calcite)
125. Stannite (reported)
126. Staurolite
127. Steatite (soapstone)
128. Stibnite
129. Strontianite
130. Sulphur
131. Tantalite
132. Tetrahedrite
133. Triphyllite
134. Triplite
135. Tourmaline
136. Uranium Arsenate
137. Wolframite
138. Wood Opal
139. Wulfenite
140. Zircon

The above list, which I first published 44 years ago in the "Hill City Tin Miner," while admittedly containing

several duplications and possibly erroneous determinations, is reprinted in **ROCKS and MINERALS** to show what an extraordinary rich field for study the mineralogist has in the Black Hills.

It may not be amiss to tell where some of the rarer minerals listed here were obtained, and to say a little about the geology of this interesting region.

The vein cassiterite in the southern Black Hills, whether black, brown, yellow, cinnamon or red in color, or whether occurring in minute crystals or in large massive chunks, is invariably found in pegmatite or granite rock. The tin ore bearing granite varies greatly in composition and structure. About 8 different phases of it have been observed, each being more or less characteristic of a certain tin mine or group of mines, to wit:

1. Normal granite, as in the Tin Reef Mine.

2. Granite in which mica and quartz predominate, either fine-grained or coarsely crystallized, as in the Coats Mine.

3. Granite in which feldspar and mica predominate, as in the February group of prospects.

4. Granite, largely composed of albite or orthoclase, as in the Bob Ingersoll and Glendale Mines.

5. Granite, with quartz as chief component, as in the Cowboy and Samelias Mines.



Courtesy of South Dakota School of Mines
Etta Lithia Mine Near Keystone, S. D.

6. Granite, largely composed of mica, as in the Campaign Mine.

7. Granite containing considerable graphite, as in the Boom Lode, and lastly

8. Spodumene Granite, as found in the Nevada No. 2 and Mattine lodes.

(See my article in the "Hill City Tin Miner" of July 4, 1890).

In the Etta Mine of the Harney Peak Tin Company in 1890, I discovered the mineral (or mineral aggregate) described as cuprocassiterite (Trans. Am. Inst. Min. Eng. for 1892). It was found in a secondary quartz vein, from a few inches to 3 feet wide, in a granite massive, and was exposed for a length of about 15 feet. An earthy mass of light yellow to malachite green color, associated with large crystals of cassiterite, it appeared to be a hydrated oxide of tin and copper containing about 62% tin and 13% copper.

In the same mine could be seen some of the world's largest crystals, such as giant logs of spodumene up to 47 feet in length and 3 by 6 feet in cross section; a mass of columbite crystals, totalling up to 600 lbs in weight; and

sheets of muscovite 3 or 4 feet across.

Nearby, and at Keystone, several other lithium minerals, besides spodumene could be obtained in the pegmatite dikes, such as large crystals or nodules of amblygonite and masses of triphylite, lithiophilite and lepidolite. Some of these minerals are of great commercial importance and the chief source of the lithia of commerce. Wolframite, in crystals up to 3 inches in length, were obtained in pegmatite near Hill City.

The northern Black Hills are noted for their tremendous output of gold, which is chiefly found native in replacement beds of pre-Cambrian carbonate rock, rich in iron and magnesium but poor in lime. South of Deadwood, about 12 miles by road and adjacent to Bear Butte Creek, lies the Galena District. Here occur silver-lead ore deposits along contacts of dolomitic limestone and rhyolite porphyrys, all in the Cambrian-Deadwood formation. In elongated vugs found in the Galena-tetrahedrite ore bodies I obtained many fine crystals of greenish-gray hornsilver (Cerargyrite) and orange-yellow Wulfenite.



Courtesy of South Dakota School of Mines
Large Crystals of Spodumene, Etta Mine, Near Keystone, S. D.



Anthracite Coal Found in West Hartford, Conn.

By C. W. HOADLEY

If we should notice in the paper a statement by Ripley that Coal was found in Hartford, Ct., most of our thoughtful citizens would smile in derision. Nevertheless, coal has been found in this immediate vicinity in the local trap-rock quarries.

As a matter of fact, back in 1837 there was a report on the geological survey of Connecticut made by Charles Upham Shepard in which he gives an interesting account of the mineralogical resources of the State as then existed, including the famous Iron mines located in the vicinity of Salisbury, the Cobalt mines in Chatham and the Copper mines which include probably the oldest copper mine in the United States located in Granby, and used by the State as a prison previous to the building of the Wethersfield institution. It might be interesting to know that this mine was opened up in 1707 and was in operation until 1787, which was a considerable period for the working of a single mine.

But in regard to the question of coal in Connecticut, Shepard says: "It is an observation as well founded as it is important in practice that coal occurs only in rocks of a peculiar nature and geological age. Good workable coal

has never been found either in the oldest crystalline rocks, or in the newest formations of the secondary and tertiary. Accordingly, in three quarters at least of our territory,—in all but the secondary region of the Connecticut River valley and the limited basin of Woodbury and Southbury,—the existence of coal is as certainly denied as is that of rock-salt in the same district." However, he does refer to Anthracite being found only in small amygdaloidal cavities in trap rock at West Hartford, and after diligent search throughout this region, the writer was rewarded in finding the anthracite, as described by Shepard, in no less a place than the Rockledge Country Club, where it was used as a filling for a parking space in front of the Club House. In this instance it occurs associated with crystalline quartz and white barite in basalt. Samuel S. Gordon,¹ who kindly identified the material, states: "It is consumed when held in the flame of a Bunsen burner leaving a fine gray ash which seems to prove it to be Anthracite."

¹ Samuel G. Gordon, Assistant Curator, Academy of Natural Sciences, Philadelphia, Pa.

Field Museum Has Large Fossil Turtle

One of the largest specimens of prehistoric land tortoise ever discovered in North America has recently been added to the exhibits of fossil animals in Ernest R. Graham Hall at Field Museum of Natural History, Chicago. The specimen, 48 inches long, shows both the shell and the internal skeleton of a great land turtle of the species *Testudo*. The shell alone is 42 inches long by 32 inches wide. The specimen was collected by a museum expedition from a sandy bluff above the North Platte River in western Nebraska. When found, the upper shell was badly

broken, but this has been carefully pieced together in the museum laboratories, and the missing parts have been restored.

Land turtles of this kind lived as early as the Oligocene period, thirty-five to thirty-nine million years ago, according to Elmer S. Riggs, associate curator of paleontology. They became widely distributed over the world. Species of *Testudo* have been found in India, Europe, Egypt and South America. Modern species, related to these fossil types, still exist in various parts of the world.

Lake City Mining District, Colorado

By DAVID SEAMAN, M.S.

Location

Lake City is located in the heart of the San Juan Mountains in the northern part of Hinsdale county. The town is situated at the junction of Lake Fork, a tributary of Gunnison River and Henson Creek which flows into it from the west. At an elevation of 8,663 feet, Lake City is nearly the lowest point in the region. The region may be easily reached by automobile by turning south 12 miles west of Gunnison from U. S. Highway No. 50. Colorado State Highway No. 149 leads directly from this point, Iola, south to Lake City.

Rocks of the Region

The rocks of the region belong almost entirely to the great intermediate member of the Tertiary volcanic series called the Silverton Volcanic Series. The rocks forming this series are chiefly augite andesite, rhyolite, latite, pyroxene andesite, and tuffs. Granite is known to form one of the foundation rocks, from exposures in the bed of Henson Creek near Capitol City.

The lavas of the Potosi series overlie the Silverton Volcanic series and appear only on the high ridges in the area.

Mineralization

The veins of the region cut all flow rocks except the Potosi Volcanic series even the monzonite porphyry intrusions which are believed to be of late Eocene age. They seem to be of late Miocene or early Pliocene age.

Ore Deposits

The ore deposits are found along Henson Creek to the west of the city for about 10 miles and along the western shores of Lake San Cristobal for about 3 miles.

The lodes of this area are chiefly fissure veins, but they show all gradations from simple filled fissures to those largely formed by replacement. Brecciation and sheeting zones are common where the deposits have been formed principally from alteration of the enclosing rock.

The veins are known to extend 5,000 feet vertically and average between 1,000 and 1,200 feet in length, the

width of the veins vary from a few inches to 20 feet and average 18 inches. The veins twist and turn along the strike similar to a flash of lightning.

Types of Lodes

Three types of lodes are characteristically developed in the region; the tetrahedrite-rhodochrosite; the quartz-galena sphalerite; and the telluride group.

The ores of the tetrahedrite-rhodochrosite group consist dominantly of galena, argentiferous tetrahedrite, much sphalerite and some pyrite in a gangue of quartz, rhodochrosite and barite. The silver value varies in proportion to the silver bearing tetrahedrite present. Examples of these ores may be found in the mines and on the dumps about 5 miles west up Henson Creek.

The veins of the quartz-galena-sphalerite group consist dominantly of galena and sphalerite and subordinate chalcocopyrite in a quartz gangue. Tetrahedrite is present in many of the mines. White barite is nearly absent. Gold values are more important in this group and seem to be associated with the large quantities of pyrite present in the ore. A gradation often exists between these veins and those of the preceding group. These veins are also developed along Henson Creek.

The telluride group contains veins in which the tellurides are disseminated through a fine grained quartz gangue. Subordinate minerals are galena, sphalerite, pyrite, chalcocopyrite, tetrahedrite, hinsdalite and barite. Hinsdalite closely associated with the tellurides in the Golden Fleece Mine, located along the western shores of Lake San Cristobal, makes this vein unique. Gold and silver are both products of this group.

Minerals Found on Field Trip June 21 - 25, 1934

Crystallized tetrahedrite and crystallized chalcocopyrite had not been found in the district up to the time of the writer's visit to the region. A specimen from the bins of the Governor Pitkin Mine, located high up on the ridge on the western shore of Lake San Cristobal, shows small light,

steel gray crystals of tetrahedrite crystallized together with small yellow chalcopyrite crystals in a small vug lined with tiny quartz crystals.

Barite, rhodochrosite, quartz, galena, sphalerite, and chalcopyrite were found on the dumps of the various mines of the area.

Fluorite was quite common in the Hidden Treasure mine located high along the top of the ridge about 3 miles west up Henson Creek along the right hand side of the road. A small specimen of colorless fluorite and also one of purple fluorite was found on the dumps of this fluorite mine.

A manganese siderite was found on the dump of the Climax Mine about 2 miles west from the town of Henson. This mineral had not been reported from the district before.

Hinsdalite in light colored grayish-green crystals resembling rhombohedrons of calcite and in small veinlets was associated with small octahedrons of pyrite, white barite, gray quartz, containing disseminated tellurides and black sulphides. It was found by the writer on the dumps of the lowest level of Golden Fleece Mine in a few specimens.

Gypsum, variety selenite, was found in a specimen from the dump of the Belle of The East Mine, located about 2 miles west of Lake City along the shore of Lake San Cristobal. This specimen shows massive quartz, containing small disseminated particles of pyrite and black metallic sulphides, coated with tiny quartz crystals upon which the selenite crystal has been deposited. Selenite has not been reported in the ores before.

Pyragyrite and proustite were not found but they occurred in large quantities in the producing mines in the early days of mining. No doubt these minerals are still present in commercial quantities but most of the mines have been idle for a long time.

Covellite and bornite are sometimes found as by-products of secondary enrichments in the ores: the covellite coating the surfaces of sphalerite and the bornite those of chalcopyrite. Both minerals were found in material from the dumps of the Ocean Wave Mine about 7 miles west up Henson Creek and along the side of the creek.

Native Gold has been noted in leaves coating crystals of sphalerite in the Gallic—Vulcan Vein, but no free gold was seen by the writer in the course of his observations in the district.

Production

In June 1934 three leasers were doing development work on the second lowest level of the Golden Fleece Mine and a little ore was being taken out.

A few men were also working at the Empire Chief Mine located 6 miles above Capitol City, which is 16 miles N. W. of Lake City along Henson Creek. Some ore was being produced at that time.

New development work will probably make better specimen material available, but many good specimens are found easily on the dumps today.

1. Bibliography U. S. Geological Survey Bulletin 478; 1911—Geology and Ore Deposits near Lake City, Colorado. By J. D. Irving and H. Bancroft.

Club and Society Notes

New Haven Mineral Club

A number of field trips for the summer have been arranged and members and their friends are urged to attend each and every one of them. The next one will be Sunday, August 18th—Tungsten Mines, Long Hill, Trumbull, Conn.

Members will meet at 9:00 A. M. (D. S. T.) at Peabody Museum, New Haven, Conn., at the mines at 10:00 A. M. (D. S. T.). Those having cars with room for an extra passenger or two, are requested to pick up members.

Subsequent trips will be listed in ROCKS and MINERALS.

"Four Uncommon Non-Metallic Occurrences In Kentucky"

By WM. C. MCKINLEY

Kentucky is mineralogically known for her deposits of fluorite, her caves of the calcium carbonate minerals, and her vast coal resources. It is, therefore, interesting to learn of several other minerals, occurring in this state, which receive little, if any, publicity.

As the results of the decomposition and reduction of sulphides, **sulphur** is found sparingly in the western Kentucky fluorite veins. Here it appears to be the result of the alteration of the lead sulphide galenite. The usual form of this sulphur, as in some coal mines, is an incrustation.

Another Kentucky mineral, also not widely distributed, is the calcium, magnesium and iron carbonate, **ankerite**. It, too, is found in the cavities of the fluorite-lead-zinc region in the western section of the state. Here it occurs either in crystals or as massive specimens. The probable formation of ankerite is due to the action of carbonated waters upon the soluble salts of cal-

cium, magnesium and iron, minerals of which all occur with ankerite in its deposits.

Both nitre and calcite are common to the Blue Grass State, and the combination product, **nitrocalcite**, occurring as efflorescent silken tufts and masses in the cave earths, is also a comparatively uncommon mineral here. Nitrocalcite is the result of the nitrification of calcium carbonate; the nitric acid is supposed to be derived through the action of nitrifying bacteria upon nitrogenous organic matter from bat droppings, etc. This product is a valuable fertilizer; it was also used, in early Kentucky history, for gun-powder manufacture!

Charles H. Richardson, geologist of the Kentucky Geological Survey, discovered in the summer of 1920, an occurrence of the uncommon magnesium oxide, **periclase**, in Hardin county. Here, near Tip Top, the periclase was found associated with mangesite in the glass sand deposits of this locality.

Collector's Kinks

Collectors are cordially invited to submit notes from their experiences and so make this department of interest to all.

Some collectors who have chemically determined a mineral as a calcium carbonate may puzzle as to whether it is Calcite or Aragonite when the mineral is not distinctly crystallized. The problem may be immediately solved for those who have the means of determining the specific gravity, as that of pure Calcite ranges between 2.71 and 2.72, while that of Aragonite is between 2.93 and 2.95. For those who have not a specific gravity balance, W. Meigen has discovered two chemical tests by which Calcite and Aragonite may be distinguished from each other.

When powdered Aragonite is boiled in a dilute solution of cobalt nitrate the powder assumes a lilac color and remains that color, while powdered

Calcite is not effected by the solution. The other test is: powdered Calcite if boiled in a solution of ferrous sulphate causes the precipitation of yellow or brownish-yellow ferric hydroxide; while Aragonite produces a dark-green precipitate, which was originally thrown down as a white precipitate but rapidly becomes a dirty green and finally a dark brown due to oxidation.

It may interest the lapidary to know that the "rouge" or ferric oxide which he uses as a final polish is commercially made in a similar way, by adding lime to a solution of ferrous sulphate thus precipitating ferric hydroxide which is then calcined.

Petaluma, Calif.

BILL NISSON.

THE AMATEUR LAPIDARY

Conducted by J. H. HOWARD*

504 Crescent Ave., Greenville, S. C.

Amateur and professional lapidaries are cordially invited to submit contributions and so make this department of interest to all.

*Author of—*The Working of Semi-Precious Stones*. A practical guide-book written in non-technical language for those who desire to cut and polish semi-precious stones.

Polishing Flats on Soft Mineral Specimens

By ARTHUR KNAPP

It is difficult to polish flats on soft mineral specimens particularly where more than one degree of hardness is involved in a single surface. The abrasive will often cut out the softer parts leaving the hard parts high.

The writer has developed the following sequence as being highly satisfactory:

1. No. 150 carbo on iron lap.
2. No. 600 carbo mixed with tripoli on a bronze lap. Do not turn the specimen around. Keep the lap in approximately one direction with respect

to the specimen thereby cutting a true flat.

3. Oxide of Tin on a sheet of glass by hand. This will not produce a polish but will reduce the grain marks of the 600 carbo until they are exceedingly fine.

4. Oxide of tin on a soft felt or wool carpet lap.

Use light pressure.

Such material as malachite, obsidian with inclusions, turquoise with soft matrix, etc. may be handled in this manner with great satisfaction.

Mineral Oddities

In a recent issue of this magazine, we referred to curious things Dame Nature did and while she occasionally makes a mess of it, at others she is really artistic. One of the members of the Rocks and Minerals Association has a specimen from Massachusetts of fasciculite in Mica Schist. Fasciculite, as our readers know is hornblende in long, flat bladed crystals. In the specimen we are describing, there were also garnets of fair size and these, in taking out the particular slab, were broken.

The result is an attractive bit of Japanese Art. The bladed fasciculite springs up in lower edges of the slab like long reeds or rushes. Some are bent as rushes often are and above them are the broken garnets which appear like flowers or blossoms of the reeds. On the reverse side is merely cross lines by the fasciculite and while being attractive as a specimen of the mineral it has not the beauty of the other side which is truly a real work of art.

Blowpipe Analysis

Mineral Manual of Science Craft Books of The Porter Chemical Company

Reviewed by H. ALBAN ANDERSON

A small volume, well deserving a place on the library shelf with English's "Getting Acquainted with Minerals" and Zodac's "How to Collect Minerals" (previously reviewed in these columns)* has just been issued by The Porter Chemical Company, of Hagerstown, Maryland. It is the Mineralogy Manual of their Science Craft Books, and is intended to accompany certain of the mineralogy outfits the company sells. However, as it appears in their list of chemicals and apparatus at a price of one dollar, it can probably be purchased separately.

The text of the Manual was prepared by Francis Burt Rosevear, A.M., Cornell University, and is well conceived, clearly written and shows much careful thought and judicious selection of material. Being intended as a guide and instructor in the technique of blowpipe and chemical tests for the determination of minerals, the essential preliminary knowledge imparted is limited to what might be regarded as the irreducible minimum. One is surprised at how little this can be, and yet on reflection how adequate for the purpose it is to serve. But then blowpipe analysis at best, being only a short cut in the determination of a mineral, is a field of operations much limited by reason of its superficiality. While quite satisfactory in "naming" a mineral, as the author says: "a good mineralogist will find out everything he can about a specimen after he has discovered what it is."

Mr. Rosevear, with excellent judgment, has stripped his ship to just enough scudding sail to give it steerageway in the direction he wishes his reader to go. Geology, chemistry, crystallography, physical properties and blowpipe and chemical tests he has

covered in five chapters occupying 26 pages of text. Yet these brief chapters are sufficiently informative to give the student the requisite knowledge, with the assistance of the two tables printed in Chapter 9, to identify for himself many of the commoner specimens he may find in the field.

The body of this book of 140 odd pages is taken up by Chapter 6, "Descriptive Mineralogy." Herein about 125 of the commoner minerals are listed under chemical groupings, and, apart from the experimental tests given for their determination, the descriptive text of each will be found of value to the amateur. After the name of the mineral its proper pronunciation is indicated by phonetic spelling, the source of the name given, when known, and the chemical formula of the mineral added. Then follows, a description of the mineral's general form and appearance; with what other minerals it may be associated; well known localities of its occurrence; its uses; its physical properties; the tests for its determination, and, lastly, its distinguishing features.

The book also contains a chapter on "Gems," and a table for the determination or identification of the commoner rocks.

The Manual is specially recommended as a companion book to the publications of English and Zodac, mentioned above. In these three volumes the amateur in Mineralogy will have an excellent working library from which he may graduate into the more technical works of the science. But should he wish to go no further, he will acquire from this small library and the collection it may lead him to make, an interest in minerals that will be a joy to him all his life.

*Getting Acquainted with Minerals. Reviewed by H. Alban Anderson, ROCKS and MINERALS, January, 1935, p. 14.

How to Collect Minerals. Reviewed by H. Alban Anderson. ROCKS and MINERALS, February, 1935, p. 31.

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